

Part One: Description of the Project Area, Bridge, Bridge Condition, and Proposal

The project involves a full and extensive rehabilitation of the Van Buren Street Bridge, which carries Van Buren Street over the Brandywine Creek. The project area is located in downtown Wilmington, New Castle County, Delaware. Please see attached Project Location Map on Figure 1.

The project area also lies within the Brandywine Park, a historic urban and landscaped architecture park that is owned by the City of Wilmington. The park, however, is managed and leased by the Division of Parks and Recreation for New Castle County.

The Van Buren Street Bridge is a 353 foot long, eight span steel and ribbed arched structure that is encased in reinforced concrete and earth (now crusher run) fill. The arched concrete bridge functions for motor vehicles, bicyclists, and pedestrians. It is also an aqueduct. The arch spans vary in length measuring, 9', 28', 28', 56', 56', 56', 33', and 33'. Arch reinforcement consists of I-beams in the short spans, and latticed, riveted girders in the longer spans; Thatcher bars reinforce the stairs and retaining walls. The bridge deck carries two lanes of traffic (approx. 10') and one sidewalk (approx. 4'), and one protective curb (approx. 1'); the concrete deck is supported on compacted fill (crusher run) over the arched ribs.

The following photographs illustrate and detail the Van Buren Street Bridge within the Brandywine Park.

The Van Buren Street Bridge is highly embellished, from the concrete substructure to the ornate balustrade. The bridge is topped with an ornate, urn shaped balustrade divided into sections which mirror the spans by dentiled short square columns and end posts.

The bridge was constructed in 1906 as a joint Project by Wilmington's Water Commission and Park Commission. The construction of the Van Buren Street Bridge was primarily intended to improve the city's early water supply. As such encased with in the concrete deck and earthen fill (now crusher run) is a 48" pipe which is currently active for approximately 42% of Wilmington's potable water supply. However, the water line system across the bridge is in desperate need of replacement. The water line (under pressure) has been actively leaking for years, which has hastened deterioration of the bridge's structural, engineering, and aesthetic condition.

According to Wilmington officials who own and maintain the water line and bridge, "as an active water line for approximately 42% of the city's potable supply, the

line must be in continual operation." In order to achieve this, the City of Wilmington plans on constructing a new and permanent water line which will be located off the bridge.

When this task is completed by the City, the new line will have interconnections (or butterfly valves) beyond the bridge's approaches which will essentially switch the system over.

Once this new system has been installed, DelDOT, who only maintains the bridge, plans to fully repair and rehabilitate the deteriorating structure.

Based on necessary bridge repair and rehabilitation needs, the extent of the project involves removal of the existing roadway/deck and roadway fill to reconstruct the reinforced arches and spandrel walls. The existing arches will remain as forms as new reinforced concrete I-beams will span between piers. Various details in Figure 2 show cross sections of proposed work. This can be better seen and detailed in Appendix A.

In order to accomplish the above work and rehabilitate/rebuild the bridge, the original water line (which will no longer be in operating service) has to be permanently removed. There is no need, feasible justification, or applicable use for reinstalling a new line back on the bridge, since the existing line is relocated. Future capacity use or maintenance needs as a redundant line on the bridge are not desired, feasible, nor operable. Therefore, part of the bridge's original function, an aqueduct across the Brandywine Creek, will no longer exist.

Numerous repair and minor rehabilitation projects have attempted to restore or correct water line failures on/across the bridge as an effort to postpone an extensive repair and rehabilitation that is now needed. It is known and well documented that much of the damage to the bridge results from water main leaks at the north and south ends. As a result, the leaks, have essentially undermined the roadway and has damaged and rusted the bridge's substructural components (the brown, black, and gold streaks). The perpetual water leaks have resulted in the proposed replacement of the water line across the bridge/waterway by the City of Wilmington in a new, but off-site, adjacent location.

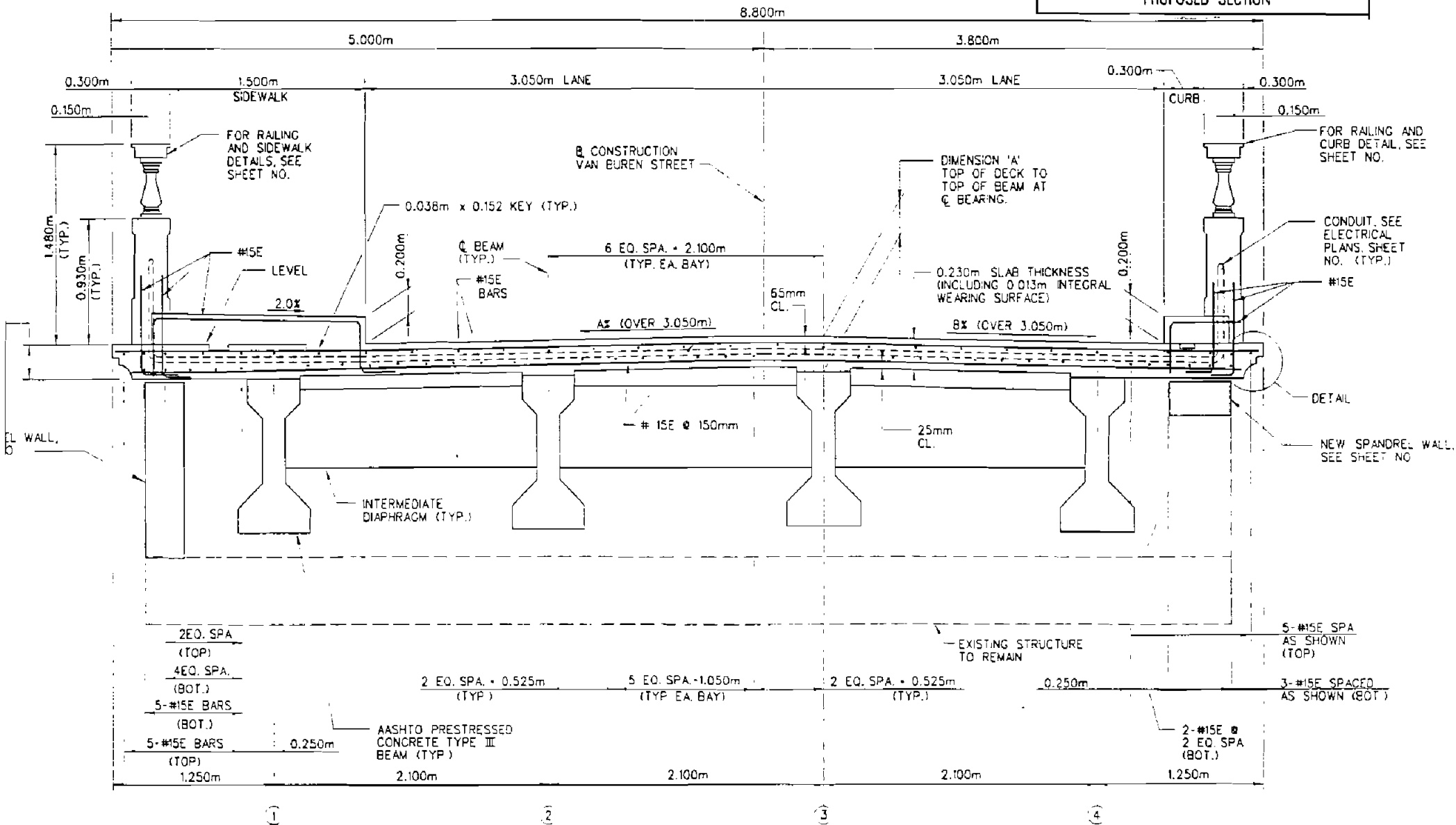
In addition, stress from vehicle travel, deck percolation of water and salts, as well as freeze-thaw activity within the bridge over time have hastened the deterioration of the bridge.

Overall, the superstructure is in serious condition with spans experiencing cracking, leaching, moisture, rust stains, spalling, and loss of earth (crusher run) fill.

More specifically, results of inspection indicate that the arched ribs are severely cracked and spalling in many places. Dripping and water seepage from the water main

CONTRACT	COUNTY	FEDERAL AID PROJECT NO.	SHEET NO.	TOTAL SHEETS
92-074-04	NEW CASTLE	EBH-698(1)	35	

VAN BUREN STREET BRIDGE OVER BRANDYWINE CREEK BRIDGE NO. I-698 PROPOSED SECTION	
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TYPICAL CROSS SECTION AT INTERMEDIATE DIAPHRAGM

SCALE: 1:20

FIGURE 2

has caused severe damage and dampness in the spandrel walls over the piers. Portions of the spandrel walls have rotted, cracked, or have spalled off. Throughout various lengths of the bridge, the spandrel walls are up to 2" - 5" out of plumb.

Numerous cracks with efflorescence and rust stains have developed at the base of the walls and in the fascia portion of the arch barrels as a result of the torsional effect of the wall rotation. At several locations, ½" to 1" gaps have opened at the construction joints between the bottom of the spandrel walls and top of the arch barrels.

Reinforced concrete balustrade parapets and pier ends have also spalled, rotted outward, and are deteriorating with the spandrel walls. The parapet sections are out of plumb and balustrade section have various gaps, cracks, or missing sections of baluster. The balustrade railings have also deteriorated due to acidic deposition caused by rain, air pollution, vehicle damage, and time. The railing end posts and intermediate posts have random cracking. The railing cap and base have transverse cracking throughout.

Current parapet configurations and designs are not crash safe. Since the parapets are open balustrade sections, they permit snagging effects when vehicles hit them. As a result over time, there is presence of vehicle damage on individual baluster sections (despite the lack of reported traffic accidents). Various construction joints between the bottom have rotated inward. There are transverse cracks. Various portions have also spalled. They are out of plumb throughout. By today's bridge and roadway standards, the overall parapet height is extremely low (3'-0" on sidewalk), and poses a serious safety concern for the high amount of pedestrians and vehicles that utilize the bridge.

A steady flow of water from the encased water main continues to leak from a drainpipe on the underside of the arch barrel near the north abutment. Rain water also seeps and percolates through from cracks and voids from the bridge deck.

Drainage inlets are filled with trash, leaves, and debris. They are clogged, resulting in new or standing drainage patterns.

Lighting fixtures are out of plumb. Current electrical wiring and conduits are out of safety code and hang unfastened along the outer cornice line. The lights are not ornamental to a park setting or time frame of the bridge.

Within the superstructure, arched barrels are rusted and corroded. There are longitudinal cracks on the underside of the arch barrels with efflorescence and rust staining.

Transverse cracks within 3' of the springing on the arched barrel undersides with efflorescence and severe rust staining. There are several areas of honey combing and deterioration of the arch barrel concrete.

At many locations, the substructure components have longitudinal cracks in their arched barrel undersides. These cracks extend through the springing and into the substructure.

There are several transverse and random cracks with efflorescence and rust staining throughout the substructure and areas of deteriorated and delaminated concrete.

Scouring up to 3' in depth are typical at the piers. The concrete footing protection aprons are undermined in several locations.

The south abutment stairways are undermined in places due to embankment erosion. The stairways, the stairway walls, and decorative railings leading into the Brandywine Park have also cracked, parged, and have spalled throughout.

Currently, based on bridge inspection results, the Van Buren Street Bridge has been listed on the Critical Bridge Action List for repair/rehabilitation. A three (3) ton limit has been posted. Closure is expected in the winter of 1996-97.

The project involves a total restoration of the Van Buren Street Bridge in order to salvage the bridge and to maintain a safe and adequate crossing for various transportation components.

The extent of the project involves an overall repair and rehabilitation scheme that will consist of the removal of the existing deck roadway and sidewalk, encased (abandoned) 48" water main, and earth fill (crusher run) to reconstruct the reinforced concrete arches. The existing arches will remain as forms as new reinforced concrete I-beams will span between piers. The new deck surface will then be poured with concrete.

The proposed deck work above is structurally and absolutely necessary. It will take all the dead and live loads off the arches. This is in order to preserve and protect the arches in-place. The arches, themselves, will be repaired where necessary and will remain as forms. The work described above has been developed to minimize as much as possible the perception of a changed bridge; from a visual/aesthetic standpoint.

In addition, outside spandrel walls on the west side and a portion on the east side will be completely parged off and rebuilt. The rebuilt walls shall match existing designs and dimensions. This includes all components of the entablature and cornice line. The east side wall over the Brandywine Creek will only be parged, patched, cleaned, and, thus, rehabilitated where needed.

Stairs and abutment wingwalls will be completely repaired/rebuilt on the west side. The east side stairway shall be parged, patched, cleaned, and partially rehabilitated or replaced where needed.

All PVC pipes, currently jetted into walls, will be removed. Holes shall be patched and sealed.

Other incidental work will involve scour and pier repair, striping/signing, cleaning and weather proofing, drainage improvements, anti-graffiti coating inside the arches, painting all exterior surfaces, recreation of original lighting designs/fixtures on the bridge, Belgian block approach improvements, brick sidewalk, and other minor repair work.

The proposed rehabilitation on the bridge will essentially mimic or replace existing elevations, dimensions, thickness and materials.

However, the incurring rehabilitation work is quite significant and the final project will be, essentially, a new bridge. In terms of architectural treatment, the bridge would be restored/rehabilitated in a manner compatible with its historic character and setting and with every effort to mirror original details. However, in terms of terms of the bridge's original historic function (part aqueduct), structural loading (only pertaining to the bridge's classification of a reinforced concrete arched bridge), and design details of the bridge parapets, changes are inherent as an effort to save the structure.

In terms of the new parapet selection, although the new parapet railing design (Detroit Superior Bridge Railing) closely imitates the current balustrade sections, it will not duplicate its attractive openness.

Other decorative features that will be included in the project will be approach roadway traffic calming measures. The approach areas will be reconstructed with a Belgian block stone pattern. On the north end, it will tie into the existing block pattern.

On the south end, it will be blocked up to the intersection with South Park Drive. The new Belgian block concepts are original to the project area.

As supplemental traffic calming, the current traffic signal at the intersection past the bridge's south approach end will be converted into a four way stop with a flashing red signal.